Glenn-Colusa Irrigation District

SB X7-7 Water Measurement Compliance Program

Glenn-Colusa Irrigation District
Serving Our Lands and Environment Sustainably
Water Rights Established in 1883

December 2016 Update

Contents

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SB X7-7 Water Measurement Compliance Program

Purpose

In accordance with California Water Code §10106.48(b), Article 2, §597.1(a), GCID is proposing to implement a program to comply with specified requirements within the Agricultural Water Measurement Regulation. This SB X7-7 Water Measurement Compliance Program (Program), which will become a component of the District's Agricultural Water Management Plan, describes how GCID will comply with the SB X7-7 water measurement requirements and adopted regulations, attached hereto as "Exhibit 4." This Program will provide the following pursuant to §597.4 (e):

1. Documentation as required to demonstrate compliance with §597, as outlined in section §597.3 and §597.4.
2. A description of best professional practices about, but not limited to, the (1) collection of water measurement data, (2) frequency of measurements, (3) method for determining irrigated acres, and (4) quality control and quality assurance procedures.
3. If a water measurement device measures flow rate, velocity or water elevation, and does not report the total volume of water delivered, the agricultural water supplier must document in its Agricultural Water Management Plan how it converted the measured value to volume. The protocols must follow best professional practices and include the following methods for determining volumetric deliveries:
    a. For devices that measure flow-rate, documentation shall describe protocols used to measure the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery.
    b. For devices that measure velocity only, the documentation shall describe protocols associated with the measurement of the cross-sectional area of flow and duration of water delivery, where volume is derived by the following formula: Volume = velocity x cross-section flow area x duration of delivery.

c. For devices that measure water elevation at the device (e.g. flow over a weir or differential elevation on either side of a device), the documentation shall describe protocols associated with the measurement of elevation that was used to derive flow rate at the device. The documentation will also describe the method or formula used to derive volume from the measured elevation value(s).

4. If an existing measurement device is determined to be out of compliance with §597.3, and the agricultural water supplier is unable to bring it into compliance before submitting its Agricultural Water Management Plan, the agricultural water supplier shall provide in its plan, a schedule, budget and finance plan for taking corrective action in three years or less.

Program Components

To comply with the SB X7-7 water measurement requirements and adopted regulations, the Program will include the following critical components:

- Proposed physical measurement alternatives and criteria.
- Proposed measurement protocols, customer billing, and reporting.
- Proposition 218 compliance to address new infrastructure costs and new rate methodologies incorporating in-part volumetric pricing.

Proposed Physical Measurement Alternatives and Criteria

The Program will employ water measurement using a combination of lateral level (upstream) turnout measurement to multiple customers, and measurement to individual customer turnouts referred to as farm-gates in §597.2(a)(8). In development of the Program, the District will develop a master plan overview of existing and proposed measurement facilities identifying the water delivery service area served by the lateral level (upstream) measurement turnouts and the service area served by individual turnouts. This master plan will also identify the measurement device at the lateral level (upstream) turnout measurement point (main canal metered laterals, main canal unmetered laterals, main canal lift pumps/pump ditches, pump recapture sites, and gravity recapture sites), or individual turnout measurement points (main canal and certain individual customer turnouts that serve individual fields). The information regarding the proposed metering methods and equipment necessary to comply with the volumetric pricing requirement, are further discussed in "Exhibit 3" which provides general, non-exclusive options for the types of devices that could be utilized to meet §597.3(a), §597.3(b)(1), and elements of §597.4 (e)(2).

A combination of lateral level (upstream) turnout measurement and individual turnout measurement is required because the options in §597.3(a) cannot be met at numerous farm-gate delivery points. In such circumstances, installation, measurement, operation, and monitoring of measurement devices at each downstream individual customer delivery point is not possible due to either one or both of the following conditions:

- GCID lacks legal access to the delivery points of individual customers or group of customers. Such cases shall be certified pursuant to §597.3(b)(2)(A).
- Small differentials in water levels from laterals to the fields, and large fluctuations in flow rate that result in poorly functioning devices. This determination shall be evaluated and certified by an engineer in accordance with §597.3(b)(2)(B).

GCID's water conveyance system presents a wide range of physical conditions that make planning for and complying with the SB X7-7 water measurement requirements challenging. In order to address these challenges, GCID will conduct a Pilot Project (See "Exhibit 1") by installing measurement devices at representative sites to identify effective metering solutions, infrastructure modification requirements, and refine costs. Site modification and construction requirements, and costing derived from the Pilot Project will provide important information to support funding requirements and the required Proposition 218 process. The Pilot Project is funded from the current GCID budget.

It is anticipated that the Pilot Project and subsequent Water Measurement Compliance Program will employ a combination of metering devices best suited to these various physical conditions. For lateral level (upstream) turnout measurement, the District will use a combination of measurement devices, which may include propeller meters, acoustic doppler meters, portable acoustic doppler meters, weirs with pressure transducers, Irrigation Training & Research Center of California Polytechnic State University San Luis Obispo (ITRC) calibrated metergates, and flumes:

A. Propeller meters with electronic flow rate and total quantity indicators will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(b)(1). The propeller meters measure velocity in pressurized pipes, which based on the cross-sectional area of the pipe is converted to an instantaneous flow rate. The totalizer on the device will report the total volume of water delivered by summing all of the previous measured instantaneous volumes to yield the total volume measured to date. (Best professional practices shall ensure that manufacturer documentation describes protocols used to measure

the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery).

B. Acoustic doppler velocity meters with electronic flow rate indicator and totalizer will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(b)(1). The acoustic doppler meter averages velocity and cross-sectional area at the measurement site over a specified time interval, which yields an average flow rate for this specified time interval. The totalizer on the device will report the total volume of water delivered by taking this average flow over a period of time. (Best professional practices shall ensure that manufacturer documentation describes protocols used to measure the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery.)

C. Portable acoustic doppler meters will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(b)(1). The portable acoustic doppler meter averages velocity and cross-sectional area at the measurement site over a specified time interval, which yields an average flow rate for this specified time interval. The average flow rate multiplied by the accumulated time duration at a constant maintained flow will yield the total volume of water delivered during the period of constant flow. (Best professional practices shall ensure that manufacturer documentation describes protocols used to measure the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery).

D. Weirs with pressure transducer measurement devices will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(b)(1). Weirs with pressure transducer measurement devices measure water elevation. This data is used in conjunction with industry standard equations and/or methodologies specific to the type of weir utilized with the pressure transducer elevation readings to determine flow. The flow shall be either programmed into a data logging device for direct report of volume, or the data will be processed in spreadsheets to obtain volume. (Best professional practices shall ensure that manufacturer documentation describes protocols used to measure the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery.) Weir measurement devices, including rectangular or v-notch weir measurement devices, will be certified by an engineer to meet the requirements of §597.4(a).

E. ITRC calibrated metergates will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(b)(1). The ITRC calibrated metergates require measurement of the following parameters: the delivery gate opening, inlet water elevation at the delivery gate, and stilling well water elevation one-foot behind the delivery gate. The measurements will be collected manually with staff gauges, tape measure, and/or survey rod. The head differential from the water elevation measurements in conjunction with the delivery gate opening yields a corresponding empirical flow rate from the respective ITRC flow rating table. The resultant flow rate multiplied by the accumulated time duration at a constant maintained flow will yield the total volume of water delivered during the period of constant flow. The flow shall be either programmed into a data logging device for direct report of volume, or the data will be processed in spreadsheets to obtain volume. (Best professional practices shall ensure that manufacturer documentation describes protocols used to measure the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery.)

F. Flume measurement devices will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(b)(1). Flumes requires a water surface elevation measurement to be collected at the prescribed location set forth from the associated flume design with the industry standard WinFlume software. The measurements can be collected with the following methods: manually with a staff gauge, pressure transducer, or an ultrasonic measurement device. The flow shall be either programmed into a data logging device for direct report of volume, or the data will be processed in spreadsheets to obtain volume. (Best professional practices shall ensure that manufacturer documentation describes protocols used to measure the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery.) Flume measurement devices, including rectangular flumes or Replogle Flumes, will be certified by an engineer to meet the requirements of §597.4(a).

Similarly, for individual turnout, farm-gate, measurement, the District will use a combination of measurement devices, which may include propeller meters, acoustic doppler meters, portable acoustic doppler meters, weirs with pressure transducers, and ITRC calibrated metergates:

A. Propeller meters with electronic flow rate and total quantity indicators will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(a).

B. Acoustic doppler meters with electronic flow rate indicator and totalizer will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(a).

C. Portable acoustic doppler meters will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(a).

D. Weir with pressure transducer measurement devices will be used on some existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(a). Rectangular or v-notch weir measurement devices will be certified to meet the water measurement requirements of §597.3(a).

E. ITRC calibrated metergates will be used on existing and future measurement sites consistent with the accuracy standards established in Regulation §597.3(a).

"Exhibit 2" presents the projected timeline for implementation of this Program, factoring in the Pilot Project process, number of metering sites, extraordinary fiscal demand in exceedance of standard operation and maintenance expenses, limited annual construction periods and physical conditions, including weather, during GCID's 6-week winter maintenance period available for the installation of the metering equipment.

Proposed Measurement Protocols, Customer Billing, and Reporting

Currently, GCID has an active and robust measurement program throughout the distribution system including main diversion points, laterals, sub-laterals, spill points, drain water recycling stations, etc. in order to effectuate good water management. Annually, the District completes a Water Measurement Report, which summarizes data on a monthly and yearly basis from all the water flow measurement points. This report is developed using a sophisticated and real-time Access database. The District has also made significant investments in Supervisory Control and Data Acquisition (SCADA), Water Information System (WIS) database, measurement reports, conjunctive use programs, conveyance improvements, and reuse facilities, all for the purpose of managing water supplies under a broad range of hydrology, delivery constraints, and ecosystem needs. This information is provided to the State Water Resources Control Board, Bureau of Reclamation, and Department of Water Resources.

A. Measurement Protocol

For this Program, the District will need to collect monthly measurement records, which will be used to develop billings to individual customers. Measurement records will be batched to the District's Water Information System to provide for a complete record of District deliveries, and then to the Water Accounting Program, which will be used to generate water user billings.

For lateral level (upstream) turnout and individual turnout measurement, the acreage and cropping pattern will be used to allocate and apportion flows to water users within a lateral or individual service area. Currently, the District generates an annual crop report that is included in the Water Measurement Report and also calculates the acreage of each crop within each service area. This information is obtained from water users during the water application process and then is confirmed by District personnel during mid-year field inspections.

B. Customer Billing

Currently, the District utilizes a customer accounting program that bills water users based on a per-acre land based assessment, a standby charge, and volumetric consumption rate based on the planted crop applied water use and evapotranspiration rate. The rates are reviewed on an annual basis and may be increased at the discretion of the Board of Directors, and as approved by landowners pursuant to a Proposition 218 rate setting process.

With a new billing structure required to comply with SB X7-7 water measurement requirements, the District will need to migrate to a new Water Accounting Program that will enable information to be downloaded from the Water Information System and to allow for lateral level and individual turnout measurement, and apportionment processes. Additionally, the District currently bills in five installments but, since in-part volumetric pricing will be required, the billing structure and collection process of the volumetric component may need to change to a monthly billing cycle.

C. Reporting

As required in §531.10(a) of the California Water Code, the District will submit an annual report to the Department that summarizes aggregated farm-gate delivery data on a monthly basis using best professional practices.

Proposition 218 Compliance to Address New Infrastructure Costs and New Rate Methodologies Incorporating In-Part Volumetric Pricing

After the Pilot Project has been completed and the District has selected the type of equipment that will be necessary to comply with SB X7-7 water measurement requirements, the District will undertake a public outreach effort that will include a series of public landowner and water user meetings to educate stakeholders on the costs and the water rate increases that will be necessary to comply with the new law. Through a series of meetings with its water users, the District will ultimately settle on one preferred rate structure, and in accordance with the requirements of California's Proposition 218, an Engineer's Report will be prepared by a registered Civil Engineering Firm. After the Engineer's Report is completed, the District will hold a public meeting to review the Engineer's Report and proposed rate structure. This meeting will trigger the start of a 45-day time period that will allow all landowners to participate in a mail ballot election on the proposed changes to the rate structure. At the end of the 45-day period, the District will hold a hearing to tally the mail ballot results and set the rates.

It is important to note that compliance with the SB X7-7 water measurement requirements will be based on the rate structure being approved by customers under Proposition 218 as required by Article XIIID of the California Constitution. Under Proposition 218, the District is not able to increase water rates or assessments to fund the Program without the approval of its landowners.

EXHIBIT 1: SB X7-7 NON-EXCLUSIVE MEASUREMENT DEVICE ALTERNATIVES PILOT PROJECT CAPITAL COST SUMMARY FOR WATER YEARS 2013-2016 TESTING

Site	Meter Manufacturer	Meter Type	Total Cost Per Site:
12-3-14R	Mace	Doppler Ultrasonic Area/Velocity Sensor	$ 8,850
Lateral 13-3	McCrometer Propeller	M1700 Digital Reverse Propeller Meter	$ 6,764
Lateral 19-1	Mace	Doppler Ultrasonic Area/Velocity Sensor	$ 7,045[2, 3]
Lateral 21-1	WinFlume/GCID	Rectangular Flume with Senix ToughSonic14	$ 76,009
Lateral 21-2	Mace	2x Doppler Ultrasonic Insert Velocity Sensors	$ 10,280
Lateral 21-4	WinFlume/GCID	Rectangular Flume with Mace EchoFlo	$ 78,449
Main Canal-49L	SonTek	IQ Pipe	$ 13,675
Lateral 26-2	SonTek	IQ Plus	$ 13,800
Juney Weir Lift Pump	Mace	Doppler Ultrasonic Insert Velocity Sensor	$ 12,463
Lateral 28-1-1L	Measurement Specialties & Briggs Mfg.	Pressure transducer and data logger with suppressed rectangular weir	$ 6,155
Lateral 29-2	SonTek	IQ Pipe	$ 12,035
Main Canal 91L	Mace	Doppler Ultrasonic Insert Velocity Sensor	$ 7,930
Lateral 35-1	Mace	Doppler Ultrasonic Area/Velocity Sensor	$ 10,220
Lateral 38-1	Mace	Doppler Ultrasonic Velocity Sensor	$ 4,613[2, 3]
Main Canal 192L	SonTek	IQ Pipe	$ 11,570[2, 3]
Lateral 54-1	McCrometer	Digital Reverse Propeller Meter M1736	$ 5,089
31 sites	ITRC Calibrated Metergate	15” ITRC Meter Gate	$ 4,308[1]
20 sites	ITRC Calibrated Metergate	18” ITRC Meter Gate	$ 4,906[1]
4 sites	ITRC Calibrated Metergate	24”ITRC Meter Gate	$ 5,274[1]
34 metergate sites	H2Otech	1x RemoteTracker Acoustic Doppler Velocimeter	$ 24,326[4]
Actual Total Cost of SB X7-7 Pilot Project			**$ 543,158**
***Simulated Total Cost* of SB X7-7 Pilot Project including device costs of relocated measurement devices**			**$ 562,037[3]**
***Simulated* Average Cost Per Site**			**$ 7,806[3]**

Please note:

I) [1] Total site cost is an average of multiple measurement device sites.

II) [2] Relocated measurement device.

III) [3] Simulated costs replicate the costs of the relocated measurement devices.

IV) [4] Portable device capable of collecting point measurements at multiple sites.

EXHIBIT 2: IMPLEMENTATION TIMELINE

Date	Action
December 2012	Complete SB X7-7 infrastructure planning and cost estimates
December 31, 2012	Complete SB X7-7 Water Measurement Compliance Program in preparation for submission to DWR pending USBR approval of Regional Water Management Plan
February 14, 2013	GCID Board of Directors review and consideration of the Regional Water Management Plan, and SB X7-7 Water Measurement Compliance Program
Phase I - Pilot Project	
March 2013 – December 2016	Conduct pilot program by installing various metering options at representative sites to assess construction requirements, confirm meter accuracy, and refine costs
March 2013 – December 2016	Operate Pilot Project metering site equipment to evaluate overall operation and accuracy
Phase II - Finalize Metering Program	
2017 – 2018	Information from the Pilot Project will be used to: - Identify actual metering solutions by site - Prepare a detailed budget and schedule for implementation
Phase III - Public Outreach and Water Rate Structure	
2019	Hold landowner/public meetings on Project cost
	Develop assessment and water rate structure alternatives and continue to gather feedback from GCID water users
Phase IV – Proposition 218 Process	
2020	Complete Engineering Report in accordance with Proposition 218 assessment and water rate requirements
	Hold landowner/public meetings on results of Engineering Report and proposed rate structure
	Begin 45-day mandatory Proposition 218 notice period
	Hold final Proposition 218 hearing, and set rates

Phase V – Installation of Metering Infrastructure	
Initialization subsequent to completion of Phase IV	Begin full-scale installation of metering infrastructure pending outcome of the Proposition 218 process It is anticipated that a maximum of 30 metering sites can be installed per year due to critical issues that impact design, construction, and installation of metering equipment, including: - Special conditions created by the presence of aquatic weed infestations - Year-round water service confines major construction activities to a 6-week period during January and February, and other limited periods when dry conditions allow - Weather conditions can limit construction activities during the winter months - Installation of metering infrastructure is dependent upon funding and successful completion of the Proposition 218 process

EXHIBIT 3: NON-EXCLUSIVE MEASUREMENT DEVICE ALTERNATIVES

Flow Condition	Measurement Device	Type of Device	Manufacturer Accuracy for New Device	SBX7-7 Accuracy Criteria	Volumetric Conversion Protocol per **§597.4 (e)(3)**	Frequency of Measurements per **§597.4 (e)(2)(2)**	Installation Criteria per **Best Professional Practices**	Collection of Water Measurement Data per **§597.4 (e)(2)(1)**
Open Channel	Measurement Specialties *730S*	Pressure transducer with stilling well	▪ ±0.1 Full Scale Output by Best-Fit Straight Line	<u>As Applicable:</u> New: Requires §597.3 (a)(2)(B); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Industry standard equation for head-discharge relationship: $V = \sum_{i=1}^{n} Q_i T_i$	5-15 minutes unless Best Professional Practices dictate otherwise	Install in a location with minimal turbulence and appropriate pressure measuring range	Real-time remote acquisition and/or monthly physical connection with device storage for download
	SonTek *IQ (Standard or Plus)*	Acoustic doppler current meter	▪ ±1% of measured velocity, ±0.5 cm/s (0.2 in/s) ▪ 0.1% of measured depth or ±0.003 m (0.01 ft) whichever is greater	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices dictate otherwise	Install at least ten channel widths upstream and downstream of any flow disturbances (i.e. gates, curves, abrupt changes in elevation)	Real-time remote acquisition and/or monthly physical connection with device storage for download
	SonTek *SL 1500*	Acoustic doppler current meter	▪ ± 1% of measured velocity, ± 0.015 ft/s ▪ ±0.3cm (0.01 ft) of measured depth ±0.1%	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices dictate otherwise	Install at least ten channel widths along a straight and uniform canal stretch with minimal turbulence	Real-time remote acquisition and/or monthly physical connection with device storage for download
	SonTek *SW*	Acoustic doppler current meter	▪ ±1% of measured velocity, ± 0.015 ft/s ▪ ±0.1% of measured depth, ±0.3 cm (0.01 ft)	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices dictate otherwise	Straight and uniform canal stretch with minimal turbulence	Real-time remote acquisition and/or monthly physical connection with device storage for download
	SonTek *IQ Pipe*	Acoustic doppler current meter	▪ ±1% of measured velocity, ±0.5 cm/s (0.2 in/s) ▪ 0.1% of measured depth or ±0.003 m (0.01 ft) whichever is greater	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices dictate otherwise	10 pipe diameters in either direction from an obstruction or flow diversion	Real-time remote acquisition and/or monthly physical connection with device storage for download
	WinFlume designed Flumes	Flumes with staff ultrasonic stage sensor, pressure transducer, or staff gauge	▪ <5% of measured flow, in accordance with specified design inputs for water elevation measurement	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(B); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} Q_i T_i$	5-15 minutes for electronic devices; planned flow changes for staff gauge	Install at least ten channel widths along a straight and uniform canal stretch with minimal turbulence	Real-time remote acquisition, monthly physical connection with device storage for download, or manual transcription

Flow Condition	Measurement Device	Type of Device	Manufacturer Accuracy for New Device	SBX7-7 Accuracy Criteria	Volumetric Conversion Protocol per **§597.4 (e)(3)**	Frequency of Measurements per **§597.4 (e)(2)(2)**	Installation Criteria per **Best Professional Practices**	Collection of Water Measurement Data per **§597.4 (e)(2)(1)**
Full Pipe	McCrometer *Mc Propeller M1700*	Propeller Open Flow meter	▪ ±2% of measured velocity with repeatability of ±0.25%	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices determine otherwise	Positioning: 10 pipe diameters upstream	Real-time remote acquisition and/or monthly physical connection with device storage for download
	McCrometer *Bolt-On Saddle Flowmeter MO300 or M1400*	Propeller meter	▪ ±2% of measured velocity with repeatability of ±0.25%	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices determine otherwise	Positioning: 10 pipe diameters upstream and two diameters downstream of the meter	Real-time remote acquisition and/or monthly physical connection with device storage for download
	Mace *Doppler Velocity Insert*	Doppler ultrasonic velocity sensor	▪ ±1% of measured velocity, up to 10 ft/s	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices determine otherwise	Positioning is valve dependent: 6-15 pipe diameters upstream and 2-6 diameters downstream	Real-time remote acquisition and/or monthly physical connection with device storage for download
	H2Otech RemoteTracker	Acoustic doppler velocimeter	▪ ±4.6%	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	Collect measurements at planned flow changes	Positioning: Weir box at turnout discharge to ensure full pipe flow with bracket to position sensor at center of pipe	Measurements are relayed to a central database via a wide wireless area network (WWAN)
	ITRC calibrated metergate	Metergate	▪ ±5%	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} Q_i T_i$	Collect measurements at planned flow changes	Install metergate assembly perpendicular to canal flow with a stilling well 12” behind the delivery gate	Measurements are manually collected, recorded, then transcribed into a database
	SonTek *IQ Pipe*	Acoustic doppler current meter	▪ ±0.1% of full scale pressure ▪ ±1% of measured velocity, ±0.5 cm/s (0.2 in/s) ▪ 0.1% of measured depth or ±0.003 m (0.01 ft) whichever is greater	<u>As Applicable:</u> New: Satisfies §597.3 (a)(2)(A); (b)(1) Existing: Requires §597.3 (a)(1); (b)(1)	Device reports total volume of water delivered using: $V = \sum_{i=1}^{n} v_i A_i T_i$	5-15 minutes unless Best Professional Practices determine otherwise	10 pipe diameters in either direction from an obstruction or flow diversion	Real-time remote acquisition and/or monthly physical connection with device storage for download

Please Note:

The Volumetric conversion protocol variables are defined below.

$$V = \sum_{i=0}^{n} v_i A_i T_i$$

V (Volume, ft^3)
Σ (summation sign)
n (final reported measurement for the year)
i (measurement number)
v_i (velocity, ft/s)
A_i (cross sectional area, ft^2)
T_i (sample time duration of measurement)

OR

$$V = \sum_{i=0}^{n} Q_i T_i$$

V (Volume, ft^3)
Σ (summation sign)
n (final reported measurement for the year)
i (measurement number)
Q_i (, ft/s)
T (sample time duration of measurement)

Essentially, these equations states that the volume of water measured over a sample time will be totalized with all previous measured volumes to yield the total volume measured thus far at that time in the year.

EXHIBIT 4: AGRICULTURAL WATER MEASUREMENT REGULATION

State of California
The Natural Resources Agency
DEPARTMENT OF WATER RESOURCES
Division of Statewide Integrated Water Management
Water Use and Efficiency Branch

Agricultural Water Measurement

A regulation included under the authority of
Section 10608.48(i) (1) and(2) of the California Water Code

July 11, 2012

Edmund G. Brown Jr. Governor State of California	**John Laird** Secretary for Natural Resources The Natural Resources Agency	**Mark W. Cowin** Director Department of Water Resources

State of California
Office of Administrative Law

In re: **Department of Water Resources**	NOTICE OF APPROVAL OF REGULATORY ACTION
Regulatory Action:	Government Code Section 11349.3
Title 23, California Code of Regulations	OAL File No. 2012-0531-01 SR
Adopt sections: 597, 597.1, 597.2, 597.3, 597.4 **Amend sections:** **Repeal sections:**	

The Department of Water Resources proposed this action to adopt five sections and create a new article in title 23 of the California Code of Regulations for agricultural water measurement. The purpose of the regulatory action is to provide a range of options that agricultural water suppliers may use or implement to comply with the water measurement requirements in Water Code 10608.48(b)(1). These regulations implement amendments to the Water Code made in S.B. 7 (Stats. 2009, 7th Ex. Sess., ch. 4).

OAL approves this regulatory action pursuant to section 11349.3 of the Government Code. This regulatory action becomes effective on 7/11/2012.

Date: 7/11/2012

Richard L. Smith
Richard L. Smith
Senior Counsel

For: DEBRA M. CORNEZ
Director

Original: Mark Cowin
Copy: Kent Frame

California Code of Regulations
Title 23. Waters
Division 2. Department of Water Resources
Chapter 5.1. Water Conservation Act of 2009
Article 2. Agricultural Water Measurement

§597. Agricultural Water Measurement

Under the authority included under California Water Code §10608.48(i)(1), the Department of Water Resources (Department) is required to adopt regulations that provide for a range of options that agricultural water suppliers may use or implement to comply with the measurement requirements in paragraph (1) of subdivision (b) of §10608.48.

For reference, §10608.48(b) of the California Water Code states that:

> *Agricultural water suppliers shall implement all of the following critical efficient management practices:*
>
> *(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2).*
>
> *(2) Adopt a pricing structure for water customers based at least in part on quantity delivered.*

For further reference, §531.10(a) of the California Water Code requires that:

> *(a) An agricultural water supplier shall submit an annual report to the department that summarizes aggregated farm-gate delivery data, on a monthly or bi-monthly basis, using best professional practices.*

Notes:

(1) Paragraphs (1) and (2) of §10608.48(b) specify agricultural water suppliers' reporting of aggregated farm-gate water delivery and adopting a volumetric water pricing structure as the purposes of water measurement. However, this article only addresses developing a range of options for water measurement.

(2) Agricultural water suppliers reporting agricultural water deliveries measured under this article shall use the "Agricultural Aggregated Farm – Gate Delivery Reporting Format for Article 2" (Rev. 6-20-12), developed for this article and hereby incorporated by reference.

(3) The Department shall report on the availability of new commercially available water measurement technologies and impediments to implementation of this article when reporting to the Legislature the status of adopted Agricultural Water Management Plans in plan submittal years 2012, 2015 and every five years thereafter as required by California Water Code §10845. The Department shall also report the findings to the California Water Commission.

Note: Authority cited: Section 10608.48, Water Code. Reference: Sections 531.10, 10608.48 (b), 10608.48 (i), 10608.52 (b) and 10845 Water Code.

§597.1. Applicability

(a) An agricultural water supplier providing water to 25,000 irrigated acres or more, excluding acres that receive only recycled water, is subject to this article.

(b) A wholesale agricultural water supplier providing water to another agricultural water supplier (the receiving water supplier) for ultimate resale to customers is subject to this article at the location at which control of the water is transferred to the receiving water supplier. However, the wholesale agricultural water supplier is not required to measure the receiving agricultural water supplier's deliveries to its customers.

(c) A water supplier providing water to wildlife refuges or habitat lands where (1) the refuges or habitat lands are under a contractual relationship with the water supplier, and (2) the water supplier meets the irrigated acreage criteria of Water Code §10608.12(a), is subject to this article.

(d) An agricultural water supplier providing water to less than 10,000 irrigated acres, excluding acres that receive only recycled water, is not subject to this article.

(e) An agricultural water supplier providing water to 10,000 or more irrigated acres but less than 25,000 irrigated acres, excluding acres that receive only recycled water, is not subject to this article unless sufficient funding is provided specifically for that purpose, as stated under Water Code §10853.

(f) A canal authority or other entity that conveys or delivers water through facilities owned by a federal agency is not subject to this article.

(g) Pursuant to Water Code §10608.8(d), an agricultural water supplier "that is a party to the Quantification Settlement Agreement, as defined in subdivision (a) of Section 1 of Chapter 617 of the Statutes of 2002, during the period within which the Quantification Settlement Agreement remains in effect," is not subject to this article.

(h) Pursuant to Water Code §10608.12(a), the Department is not subject to this article.

Note: Authority cited: Section 10608.48, Water Code. Reference: Sections 10608.12 (a), 10608.48 (d), 10608.48 (f), 10828, and 10853 Water Code.

§597.2. Definitions

(a) For purposes of this article, the terms used are defined in this section.

(1) "Accuracy" means the measured volume relative to the actual volume, expressed as a percent. The percent shall be calculated as 100 x (measured value – actual value) / actual value, where "measured value" is the value indicated by the device or determined through calculations using a measured value by the device, such as flow rate, combined with a duration of flow, and "actual value" is the value as determined through laboratory, design or field testing protocols using best professional practices.

(2) "Agricultural water supplier," as defined in Water Code §10608.12(a), means a water supplier, either publicly or privately owned, providing water to 10,000 or more irrigated acres, excluding acres that receive only recycled water. "Agricultural water supplier" includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells water for ultimate resale to customers. "Agricultural water supplier" does not include the Department.

(3) "Approved by an engineer" means a California-registered Professional Engineer has reviewed, signed and stamped the plans, design, testing, inspection, and/or documentation report for a measurement device as described in this article.

(4) "Best professional practices" means practices attaining to and maintaining accuracy of measurement and reporting devices and methods described in this article, such as operation and maintenance procedures and practices recommended by measurement device manufacturers, designers, and industry professionals.

(5) "Customer" means the purchaser of water from an agricultural water supplier who has a contractual arrangement with the agricultural water supplier for the service of conveying water to the customer delivery point.

(6) "Delivery point" means the location at which the agricultural water supplier transfers control of delivered water to a customer or group of customers. In most instances, the transfer of control occurs at the farm-gate, which is therefore, a delivery point.

(7) "Existing measurement device," means a measurement device that was installed in the field prior to the effective date of this article.

(8) "Farm-gate," as defined in Water Code §531(f), means the point at which water is delivered from the agricultural water supplier's distribution system to each of its customers.

(9) "Irrigated acres," for purposes of applicability of this article, is calculated as the average of the previous five-year acreage within the agricultural water supplier's service area that has received irrigation water from the agricultural water supplier.

(10) "Manufactured device" means a device that is manufactured by a commercial enterprise, often under exclusive legal rights of the manufacturer, for direct off-the-shelf purchase and installation. Such devices are capable of directly measuring flow rate, velocity, or accumulating the volume of water delivered, without the need for additional components that are built on-site or in-house.

(11) "Measurement device" means a device by which an agricultural water supplier determines the numeric value of flow rate, velocity or volume of the water passing a designated delivery point. A measurement device may be a manufactured device, on-site built device or in-house built device.

(12) "New or replacement measurement device" means a measurement device installed after the effective date of this article.

(13) "Recycled water" is defined in subdivision (n) of §13050 of the Water Code as water that, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur, and is therefore considered a valuable resource.

(14) "Type of device" means a measurement device that is manufactured or built to perform similar functions. For example, rectangular, v-notch, and broad crested weirs are one type of device. Similarly, all submerged orifice gates are considered one type of device.

Note: Authority cited: Section 10608.48, Water Code. Reference: Sections 10608.12 (a), 10608.12 (m), 10608.48, and 10813 Water Code.

§597.3 Range of Options for Agricultural Water Measurement

An agricultural water supplier subject to this article shall measure surface water and groundwater that it delivers to its customers pursuant to the accuracy standards in this section. The supplier may choose any applicable single measurement option or combination of options listed in paragraphs (a) or (b) of this section. Measurement device accuracy and operation shall be certified, tested, inspected and/or analyzed as described in §597.4 of this article.

(a) Measurement Options at the Delivery Point or Farm-gate of a Single Customer

An agricultural water supplier shall measure water delivered at the delivery point or farm-gate of a single customer using one of the following measurement options. The stated numerical accuracy for each measurement option is for the volume delivered. If a device measures a value other than volume, for example, flow rate,

velocity or water elevation, the accuracy certification must incorporate the measurements or calculations required to convert the measured value to volume as described in §597.4(e).

(1) An existing measurement device shall be certified to be accurate to within ±12% by volume.

and,

(2) A new or replacement measurement device shall be certified to be accurate to within:

(A) ±5% by volume in the laboratory if using a laboratory certification;

(B) ±10% by volume in the field if using a non-laboratory certification.

(b) Measurement Options at a Location Upstream of the Delivery Points or Farm-gates of Multiple Customers

(1) An agricultural water supplier may measure water delivered at a location upstream of the delivery points or farm-gates of multiple customers using one of the measurement options described in §597.3(a) if the downstream individual customer's delivery points meet either of the following conditions:

(A) The agricultural water supplier does not have legal access to the delivery points of individual customers or group of customers needed to install, measure, maintain, operate, and monitor a measurement device.

Or,

(B) An engineer determines that, due to small differentials in water level or large fluctuations in flow rate or velocity that occur during the delivery season at a single farm-gate, accuracy standards of measurement options in §597.3(a) cannot be met by installing a measurement device or devices (manufactured or on-site built or in-house built devices with or without additional components such as gauging rod, water level control structure at the farm-gate, etc.). If conditions change such that the accuracy standards of measurement options in §597.3(a) at the farm-gate can be met, an agricultural water supplier shall include in its Agricultural Water Management Plan, a schedule, budget and finance plan to demonstrate progress to measure water at the farm-gate in compliance with §597.3(a) of this article.

(2) An agricultural water supplier choosing an option under paragraph (b)(1) of this section shall provide the following current documentation in its Agricultural Water Management Plan(s) submitted pursuant to Water Code §10826:

(A) When applicable, to demonstrate lack of legal access at delivery points of individual customers or group of customers downstream of the point of measurement, the agricultural water supplier's legal counsel shall certify to the Department that it does not have legal access to measure water at customers delivery points and that it has sought and been denied access from its customers to measure water at those points.

(B) When applicable, the agricultural water supplier shall document the water measurement device unavailability and that the water level or flow conditions described in §597.3(b)(1)(B) exist at individual customer's delivery points downstream of the point of measurement as approved by an engineer.

(C) The agricultural water supplier shall document all of the following criteria about the methodology it uses to apportion the volume of water delivered to the individual downstream customers:

(i) How it accounts for differences in water use among the individual customers based on but not limited to the duration of water delivery to the individual customers, annual customer water use patterns, irrigated acreage, crops planted, and on-farm irrigation system,

and;

(ii) That it is sufficient for establishing a pricing structure based at least in part on the volume delivered,

and;

(iii) That it was approved by the agricultural water supplier's governing board or body.

Note: Authority cited: Section 10608.48, Water Code. Reference: Sections 531.10, 10608.48 *(i)* (1), and 10826 Water Code.

§597.4 Accuracy Certification, Records Retention, Device Performance, and Reporting

(a) Initial Certification of Device Accuracy

The accuracy of an existing, new or replacement measurement device or type of device, as required in §597.3, shall be initially certified and documented as follows:

(1) For existing measurement devices, the device accuracy required in section 597.3(a) shall be initially certified and documented by either:

(A) Field-testing that is completed on a random and statistically representative sample of the existing measurement devices as described in §597.4(b)(1) and §597.4(b)(2). Field-testing shall be performed by individuals trained in the use of field-testing equipment, and documented in a report approved by an engineer.

Or,

(B) Field-inspections and analysis completed for every existing measurement device as described in §597.4(b)(3). Field-inspections and analysis shall be performed by trained individuals in the use of field inspection and analysis, and documented in a report approved by an engineer.

(2) For new or replacement measurement devices, the device accuracy required in sections 597.3 (a)(2) shall be initially certified and documented by either:

(A) Laboratory Certification prior to installation of a measurement device as documented by the manufacturer or an entity, institution or individual that tested the device following industry-established protocols such as the National Institute for Standards and Testing (NIST) traceability standards. Documentation shall include the manufacturer's literature or the results of laboratory testing of an individual device or type of device.

Or,

(B) Non-Laboratory Certification after the installation of a measurement device in the field, as documented by either:

(i) An affidavit approved by an engineer submitted to the agricultural water supplier of either (1) the design and installation of an individual device at a specified location, or (2) the standardized design and installation for a group of measurement devices for each type of device installed at specified locations.

Or,

(ii) A report submitted to the agricultural water supplier and approved by an engineer documenting the field-testing performed on the installed measurement device or type of device, by individuals trained in the use of field testing equipment.

(b) Protocols for Field-Testing and Field-Inspection and Analysis of Existing Devices

(1) Field-testing shall be performed for a sample of existing measurement devices according to manufacturer's recommendations or design specifications and following best professional practices. It is recommended that the sample size be no less than 10% of existing devices, with a minimum of 5, and not to exceed 100 individual devices for any particular device type. Alternatively, the supplier may develop its own sampling plan using an accepted statistical methodology.

(2) If during the field-testing of existing measurement devices, more than one quarter of the samples for any particular device type do not meet the criteria pursuant to §597.3(a), the agricultural water supplier shall provide in its Agricultural Water

Management Plan, a plan to test an additional 10% of its existing devices, with a minimum of 5, but not to exceed an additional 100 individual devices for the particular device type. This second round of field-testing and corrective actions shall be completed within three years of the initial field-testing.

(3) Field-inspections and analysis protocols shall be performed and the results shall be approved by an engineer for every existing measurement device to demonstrate that the design and installation standards used for the installation of existing measurement devices meet the accuracy standards of §597.3(a) and operation and maintenance protocols meet best professional practices.

(c) Records Retention

Records documenting compliance with the requirements in §597.3 and §597.4 shall be maintained by the agricultural water supplier for ten years or two Agricultural Water Management Plan cycles.

(d) Performance Requirements

(1) All measurement devices shall be correctly installed, maintained, operated, inspected, and monitored as described by the manufacturer, the laboratory or the registered Professional Engineer that has signed and stamped certification of the device, and pursuant to best professional practices.

(2) If an installed measurement device no longer meets the accuracy requirements of §597.3(a) based on either field-testing or field-inspections and analysis as defined in sections 597.4 (a) and (b) for either the initial accuracy certification or during operations and maintenance, then the agricultural water supplier shall take appropriate corrective action, including but not limited to, repair or replacement to achieve the requirements of this article.

(e) Reporting in Agricultural Water Management Plans

Agricultural water suppliers shall report the following information in their Agricultural Water Management Plan(s):

(1) Documentation as required to demonstrate compliance with §597.3 (b), as outlined in section §597.3(b)(2), and §597.4(b)(2).

(2) A description of best professional practices about, but not limited to, the (1) collection of water measurement data, (2) frequency of measurements, (3) method for determining irrigated acres, and (4) quality control and quality assurance procedures.

(3) If a water measurement device measures flow rate, velocity or water elevation, and does not report the total volume of water delivered, the agricultural water supplier must document in its Agricultural Water Management Plan how it converted the

measured value to volume. The protocols must follow best professional practices and include the following methods for determining volumetric deliveries:

(A) For devices that measure flow-rate, documentation shall describe protocols used to measure the duration of water delivery where volume is derived by the following formula: Volume = flow rate x duration of delivery.

(B) For devices that measure velocity only, the documentation shall describe protocols associated with the measurement of the cross-sectional area of flow and duration of water delivery, where volume is derived by the following formula: Volume = velocity x cross-section flow area x duration of delivery.

(C) For devices that measure water elevation at the device (e.g. flow over a weir or differential elevation on either side of a device), the documentation shall describe protocols associated with the measurement of elevation that was used to derive flow rate at the device. The documentation will also describe the method or formula used to derive volume from the measured elevation value(s).

(4) If an existing water measurement device is determined to be out of compliance with §597.3, and the agricultural water supplier is unable to bring it into compliance before submitting its Agricultural Water Management Plan in December 2012, the agricultural water supplier shall provide in its 2012 plan, a schedule, budget and finance plan for taking corrective action in three years or less.

Note: Authority cited: Section 10608.48, Water Code. Reference: Sections 531.10, 10608.48 *(i)* (1), and 10826 Water Code.

Agricultural Aggregated Farm-Gate[1] Delivery Reporting Format for Article 2

Due annually beginning no later than July 31, 2013 from agricultural water suppliers subject to Title 23, Division 2, Chapter 5.1, Article 2 of the CCR - Agricultural Water Measurement

1. Water Supplier Information

Name:

Address:

Phone Number:

Fax:

Total Number of Farm-Gates:

Number of Measured Farm-Gates:

Service Area Acreage:

2. Contact information

Name:

Title:

Address:

Phone Number:

Fax:

E-mail:

Submittal date:

3. Aggregated Farm-Gate Delivery Data[2]: (*provide monthly or bimonthly data, acre-feet*)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Monthly Deliveries													

	Jul-Aug	Sep-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May-Jun	Total
Bimonthly Deliveries							

4. Explanations, Comments and Best Professional Practices[3]:

Note: An agricultural water supplier's total water use may be different from Aggregated Farm-Gate deliveries because measurement at these points may not account for other practices (such as groundwater recharge/conjunctive use, water transfers, wheeling to other agencies, urban use, etc).

1. "Farm-gate" means the point at which water is delivered from the agricultural water supplier's distribution system to each of its individual customers as specified in the Agricultural Water Measurement Regulation (Title 23, Division 2, Chapter 5.1, Article 2 of the CCR).
2. "Aggregated farm-gate delivery data" means information reflecting the total volume of water an agricultural water supplier provides to its customers and is calculated by totaling its deliveries to customers.
3. "Best Professional Practices" is defined in Title 23, Division 2, Chapter 5.1, Article 2 of the CCR, Section 597.2.